

In the United States Court of Federal Claims

No. 12-216C

(Filed: April 17, 2017)

UUSI, LLC, and OLDNAR CORP.,

Plaintiffs,

v.

THE UNITED STATES,

Defendant

and

AM GENERAL, LLC.,

Third-Party Defendant.

**28 U.S.C. § 1498(a); Patent Infringement;
Claim Construction; Indefiniteness; 35
U.S.C. § 112, ¶ 2; Means Plus Function
Claim; 35 U.S.C. § 112, ¶ 6.**

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CLAIM CONSTRUCTION OPINION AND ORDER

WILLIAMS, Judge.

In this action, Plaintiffs UUSI, LLC and OLDNAR Corporation allege infringement of United States Patent Nos. 5,327,870; 5,729,456; 6,009,369; 6,148,258; 5,413,072; 5,507,255; and 5,570,666 through Third-Party Defendant AM General LLC's ("AM General") use and manufacture of starting systems for High Mobility Multipurpose Wheeled Vehicles for Defendant, the United States.¹ The patents-in-suit are directed to glow plugs - - the heating elements used to assist diesel engine start-up - - and glow plug controllers that cycle power to the glow plugs. The parties dispute the construction of claim terms in two of the seven asserted patents-in-suit - - U.S. Patent Nos. 5,327,870 ("the '870 Patent") and 6,148,258 ("the '258 Patent").

Background²

The patents-in-suit implicate various aspects of operating glow plugs - - heating devices used in diesel engines that aid in the combustion of fuel particularly during engine start-up. '258 Patent 1:29-31, 63-67. Diesel engines function by compressing air in a combustion chamber which causes the air to heat up to a temperature where fuel, when injected into the combustion chamber, will spontaneously ignite and continue to burn. '258 Patent 1:44-52. This fuel-air mixture "will not ignite" or "run efficiently" if the engine is cold. '258 Patent 1:52-54. Glow plugs are employed to help heat diesel engine compression chambers when ignition and combustion are impaired by "varying conditions" and thus are not able to reach "minimal operational temperature."

The '258 Patent explains:

Varying conditions (some widely varying) including: Engine temperature, ambient air temperature, ambient air absolute density, mass air flow, engine compression ratio, and fuel flash point temperature (being also some interrelated function of the above variable conditions) require various amounts of supplemental heat to be added to the combustion chamber prior to and during engine cranking and warmup to enable fuel ignition with sufficient combustion for engine operation during engine cranking conditions and cold engine warm up operation. To assist in bringing the combustion chambers above the necessary minimal operational

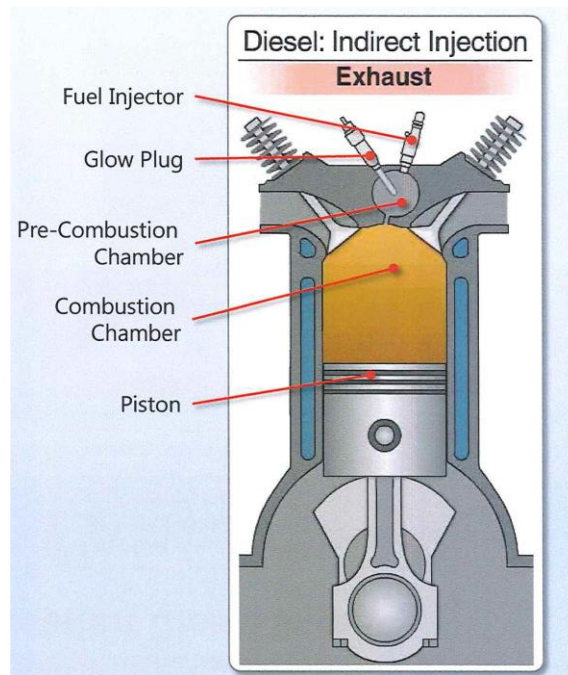
¹ On July 11, 2016, Plaintiffs withdrew their infringement allegations related to U.S. Patent No. 5,287,831, leaving seven remaining patents-in-suit. Notice Regarding Terms Previously Identified for Claim Construction 1 (July 11, 2016).

² This background is derived from the record developed at the claim construction hearing. The Court has not corrected grammatical errors in quotations from the record. Plaintiffs' and Defendants' demonstrative exhibits admitted during the claim construction hearing are labeled PDX, and DDX, respectively.

temperature and/or to supply a source of combustion chamber ignition temperature, diesel engine glow plug heaters, otherwise called glow plugs, are employed.

'258 Patent 1:54-67.

The following image depicts a diesel engine combustion chamber with a glow plug just above the chamber:



DDX 4 at 22.

The following image shows a hot glow plug:



PDX 1 at 9.

The design of circuitry systems can improve glow plug operation by tailoring the temperature and duration of supplying power, or "energization" to the glow plug prior to engine start-up - - called preglow - - and then cycling power to pulse heat to the glow plugs so that a

combustion chamber maintains a steady temperature - - called afterglow. '258 Patent 2:1-10; 2:22-41. Poorly regulated glow plug energization times lead to undesirable effects on engine start-up and efficiency:

Excessive glow plug power energization time causes higher than desired glow plug temperatures which can result in significantly shortened life of the glow plugs, in addition to wasting of energy and unnecessary long time before the engine can be started. Insufficient glow plug power ON time will cause lower than desired glow plug temperatures and reduced supplemental heat which can result in: Inability to start engine, excessive cranking time, starter motor wear, undesirable hydrocarbon exhaust emissions, white smoke of completely combusted fuel, increased fuel consumption[.]

'258 Patent 2:1-10.

Overview of U.S. Patent No. 5,327,870

The '870 Patent titled "Glow Plug Controller" was filed on August 26, 1993, and issued on July 12, 1994. The '870 Patent is a continuation in part of U.S. Patent Application No. 07/785,462 filed October 31, 1991, now abandoned.

The '870 Patent is directed to the housing and circuitry of a glow plug controller with a "packaging means for facilitating rapid and inexpensive assembly." '870 Patent Abstract.³ The described packaging is a "two-chamber tubular housing" with a smaller first chamber and a larger second chamber. '870 Patent Abstract. The "general object" of the '870 Patent is to "provide improved glow plug controller circuitry, and mounting and housing structure for such a glow plug controller, to enhance the efficacy of control of operation of the glow plugs . . . and to enhance the durability, reliability and ease of assembly of the glow plug controller." '870 Patent 3:11-17. Only one term is at issue in this patent - - the term "remote" that appears in Claim 9, which depends on Claim 1.

Independent Claim 1 is illustrative of the '870 Patent:

1. A glow plug controller comprising:
 - a) a generally tubular housing having a wall defining a first chamber and a second chamber and a second chamber communicating with said first chamber, the portion of the outer surface of the wall which defines said first chamber being a threaded portion for threaded engagement in hole;
 - b) glow plug controller circuitry^[4] including a temperature sensor located within said threaded portion and circuitry for controlling glow plug operation as a function of sensed temperature, said temperature sensor being located within said

³ The parties did not include any excerpts from the prosecution history of the '870 Patent in their briefing.

⁴ The parties stipulated to construe "glow plug controller circuitry" to mean "circuitry that controls the operation of one or more glow plugs." Pls.' Notice 3 (July 27, 2016).

- first chamber and wherein glow plug controller circuitry is located within said second chamber of said housing; and
- c) means for conductively coupling said glow plug controller circuitry to other circuitry external to said housing.

'870 Patent 10:43-60 (as amended by a Certificate of Correction dated September 20, 1994).

Claim 9 depends on Claim 1 and contains the disputed term "remote," and states:

9. The glow plug controller of Claim 1, wherein:
- a) said glow plug controller circuitry comprises power supply circuitry, and
- b) said power supply circuitry is located within said housing at a location remote from said temperature sensor.

'870 Patent 11:23-28 (emphasis added).

Overview of U.S. Patent No. 6,148,258

The '258 Patent titled "Electrical Starting System for Diesel Engines" issued on November 14, 2000, from U.S. Application No. 09/076,291 ("the '291 Application") filed May 12, 1998. The '291 Application is a continuation-in-part of U.S. Application No. 08/931,470, which is a continuation-in-part of Application No. 08/508,063, which is a continuation of Application No. 08/042,239, which is a continuation of Application No. 07/785,462, filed on October 31, 1991, now abandoned. The claims of the '258 Patent expired on November 14, 2012, due to nonpayment of maintenance fees. Institution Decision, AM Gen., LLC v. UUSI, LLC, No. IPR 2016-01050 (P.T.A.B. Nov. 14, 2016) ("Institution Decision").⁵

The '258 Patent is directed to an "integrated electronic starting control system module for diesel engines." '258 Patent Abstract. This "integrated" modular device improves "control, performance, diagnostics, monitoring, adaptability, and compensation pertaining to glow plugs, starter motor actuation, and battery power application for diesel engine applications." '258 Patent 1:17-22. By integrating and incorporating this improved circuitry "into a single engine electronic starting system," or EESS, the claimed invention of the '258 Patent produces "a multiplicity of desirable characteristics for implementing the safe, reliable and efficient operation of the components of a diesel engine electrical control system." '258 Patent 3:26-31.

Independent Claim 1 is illustrative of the invention:

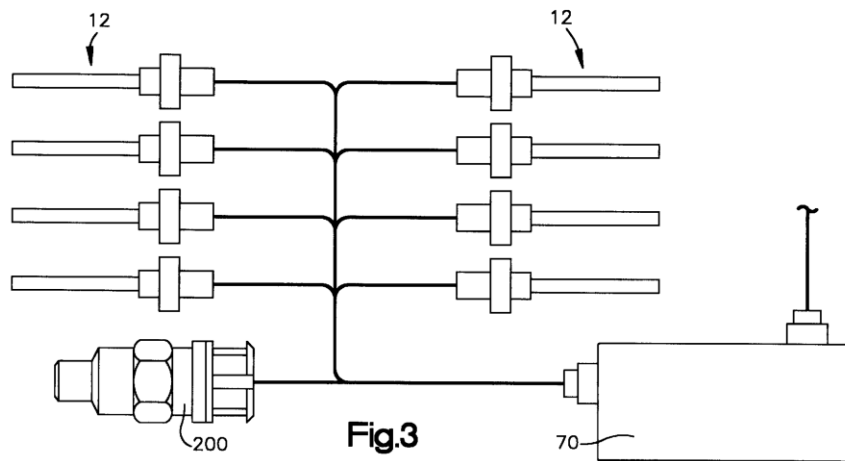
1. For use with a motor vehicle diesel engine having one or more glowplugs for maintaining temperature control of one or more diesel engine combustion chambers, apparatus comprising:

⁵ The '258 Patent is currently subject to an inter partes review proceeding before the Patent Trial and Appeal Board) ("PTAB"). In the PTAB proceeding, Plaintiff UUSI asserted that Claims 17 and 18 of the '258 Patent do not expire until May 12, 2018, based on claim amendments that recite new subject matter.

- a) a starter control housing supported by the motor vehicle and including a cable connector for routing energization signals into a housing interior from a vehicle mounted power source for use in energizing the glow-plugs;
- b) monitor circuitry supported within a housing interior for providing an indicator signal corresponding to a voltage applied to the one or more glowplugs;
- c) a programmable controller supported within the housing interior that is coupled to the monitor circuitry and produces a control output for supplying energy to the glowplugs;
- d) at least one switching device supported within the housing interior that is coupled to the control output from the programmable controller for energizing the one or more glow plugs in a controlled time sequence prior to, during an/or after engine cranking by selectively coupling the energization signals to the glowplugs; and
- e) load protection circuitry supported within the housing interior for temporarily maintaining an alternator to battery power correction after removal or an ignition signal until engine speed has been reduced to a specified value.

'258 Patent 23:33-60.

Figure 3 of the '258 Patent depicts the glow plug system, showing eight glow plugs, the glow plug controller, and the housing for the electrical starting system:



'258 Patent Fig. 3.

The '258 Specification elaborates on Figure 3:

The preferred embodiment of the present invention is for use with a motor vehicle diesel engine having one or more glowplugs 12 for maintaining temperature control of one or more diesel engine combustion chambers. The exemplary embodiment includes a housing 70 supported by the motor vehicle and including a connector for

routing signals from a vehicle mounted power source that energizes the glowplugs into said housing.

'258 Patent 6:48-55. The housing 70 contains multiple circuitry systems coupled to one another in a specific sequence. The circuitry systems include: 1) monitoring circuitry, 2) a programmable controller containing circuitry that "produces a control output for supplying energy to the glow plugs," 3) a switching device that "energizes the one or more glow plugs in a controlled time sequence prior to initiation of combustion," and 4) a maintenance circuit that "maintains power to current drawing loads of the motor vehicle after removal of an ignition signal." '258 Patent 6:55-7:1.

Inter Partes Review of the '258 Patent

On May 18, 2016, AM General filed a petition for inter partes review of the '258 Patent.⁶ On August 19, 2016, UUSI, LLC filed its Preliminary Response. On November 14, 2016, the PTAB issued its Institution Decision, granting inter partes review of the '258 Patent. Institution Decision 31.⁷ The PTAB made preliminary claim construction findings on three terms at issue

⁶ Inter partes review is a Patent Office procedure that allows third parties to seek cancellation of an issued patent on grounds of anticipation or obviousness. 35 U.S.C. § 100 *et seq* (2012). The first stage of this procedure, the "institution stage," involves the third party filing a petition for review that sets forth the grounds for challenging the patent claims' issuance. A patent owner may file a preliminary response stating why the PTAB should not review the petition. Based on the petition and the patent owner's preliminary response, a panel of three administrative judges issues an "Institution Decision," which contains preliminary findings on claim construction and on whether the petitioner has shown "a reasonable likelihood that it would prevail [in showing unpatentability] as to at least 1 of the claims challenged." 35 U.S.C. § 314(a). The Institution Decision is subject to change based on the parties' future filings. If the PTAB institutes inter partes review, then the procedure moves into the "trial stage." The trial stage ends when the PTAB panel issues a "Final Written Decision" on the subject claims' patentability. Only final written decisions, not institution decisions, are appealable to the United States Court of Appeals for the Federal Circuit. 35 U.S.C. §§ 314(d), 319 (2012); Cuozzo Speed Techs., LLC v. Lee, 136 S. Ct. 2131, 2142 (2016).

⁷ In inter partes review proceedings, the PTAB cannot consider whether a claim is indefinite under 35 U.S.C. § 112, but rather is limited to reviewing claims for anticipation under 35 U.S.C. § 102 and obviousness under 35 U.S.C. § 103. 37 C.F.R. § 42.104(b)(2). In addition, during the institution phase, the patent owner is not required to respond to the petitioner's allegations, and any factual dispute raised by a patent owner is viewed in a light most favorable to the petitioner. See 37 C.F.R. §§ 42.107(a), 42.108 ("The Board's [institution] decision will take into account a patent owner preliminary response where such a response is filed, including any testimonial evidence, but a genuine issue of material fact created by such testimonial evidence will be viewed in the light most favorable to the petitioner solely for the purposes of deciding whether to institute inter partes review.").

here - - “until,” “a voltage signals,” and “power correction after removal or an ignition signal” - - as follows:

Term	PTAB Institution Decision Construction
“power correction after removal or an ignition signal”	“power connection after removal of an ignition signal.” Institution Decision 13.
“a voltage signals”	No construction made, institution of Claim 9 denied as the “scope of Claim 9 cannot be determined without speculation.” Institution Decision 15.
“until”	“up to the point, but not thereafter” Institution Decision 19.

Because claims cannot be amended in expired patents, the PTAB construes expired claims under the standard applied by the trial court in Phillips v. AWH Corp., 415 F.3d 1303, 1312 (Fed. Cir. 2005) (en banc). As the '258 Patent expired on November 14, 2012, the PTAB applied the Phillips standard to its constructions. The PTAB proceeding is currently ongoing, and the PTAB's claim constructions in its Institution Decision are subject to change.

Discussion

Jurisdiction

The Court has subject-matter jurisdiction over this action pursuant to 28 U.S.C. § 1498(a). That statute provides in relevant part:

Whenever an invention described in and covered by a patent of the United States is used or manufactured by or for the United States without license of the owner thereof or lawful right to use or manufacture the same, the owner's remedy shall be by action against the United States in the United States Court of Federal Claims for the recovery of his reasonable and entire compensation for such use and manufacture.

28 U.S.C. § 1498(a) (2012).

The patents-in-suit were originally assigned to Nartron Corporation - - now known as OLDNAR. Am. Compl. ¶ 1. In 2009, Nartron Corporation assigned UUSI ownership of all the patents-in-suit, including “the right to assert infringement actions and to collect damages or seek other remedies regardless of when the infringement occurred, including past infringement.” Id. at ¶ 3. Plaintiffs UUSI and OLDNAR allege that the United States infringed the following patent claims through AM General's use and manufacture of High Mobility Multipurpose Wheeled Vehicles for several Government agencies including the Army, Air Force, Navy, Marine Corps, National Guard, and Border Patrol, without license or lawful right:

U.S. Patent Number	Asserted Claims
5,327,870	7, 9, and 16
5,413,072	4 and 6
5,507,255	4
5,570,666	11 and 13
5,729,456	1, 3, 5, 8, and 9
6,009,369	1, 3, 6, 9, 13, 17, 18, 21, 22, 26, 31, and 33
6,148,258	9, 11, 12, 18, and 31

Pls.' Br. 1; see Am. Compl. ¶ 13.

Stipulated Claim Terms

The parties agreed to the following constructions:

Claim Term	Agreed-Upon Construction
Circuitry	Circuitry
a monitor	a sensing device
during an/or after	during and/or after
Positioned	Positioned
Convertor	Converter
oscillator means to provide a clock signal for operations in conjunction with glow plug controller circuitry	oscillator clock
means for conductivity coupling said glow plug controller circuitry to other circuitry external to the housing	<p>Function: Conductively coupling glow plug controller circuitry to other circuitry external to the housing</p> <p>Structure: Conductive connector pins or connector pins in conjunction with conductive foil layers on the surface of the glow plug controller circuitry or equivalents thereof</p>

digital logic means	digital circuit that performs Boolean algebra
circuitry for controlling glow plug operation	circuitry that controls the operation of one or more glow plugs
glow plug controller circuitry	circuitry that controls the operation of one or more glow plugs
latching circuitry to inhibit the reactivation of the wait-to-start lamp prior to the subsequent toggling of the ignition switch	latching circuitry which inhibits the wait-to-start lamp from re-illuminating until the ignition switch is turned off then back on.
means for preventing damage to the switching device by application of too large a voltage signal	<p>Function: Preventing damage to the switching device by application of too large a voltage signal</p> <p>Structure: (1) a microprocessor that keeps the switching device closed for some period of time after the ignition switch is turned to the off position until “the alternator is at a sufficiently safe and low speed” (as described at col. 2 lines 13 through 14 and col. 4 lines 55 through 64), or (2) the load protection circuit shown as item 330 of Fig. 8 and described at col. 14 line 45 through 47, or (3) the “load dump control circuitry” of U.S. Patent 5,287,831 made reference to in the ’369 patent at col. 4 lines 10 through 21, and equivalents thereof</p>

Pls.’ Notice 2-3.

Disputed Claim Terms

The parties identified five claim terms for this Court to construe:

Patent Claims	Term to be Construed
’870 Patent, Claim 9	“located within said housing remote from”
’258 Patent, Claim 1	“until”
’258 Patent, Claim 9	“a voltage signals”
’258 Patent, Claim 9	“power correction after removal or an ignition signal”

'258 Patent, Claim 29	“means based on various sensed conditions to adjust to a preglow energization time and an afterglow energization time to limit excessive temperatures of the glow plugs while applying adequate glow plug energy to facilitate engine starting and warmup”
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Id. at 2.

Legal Standards for Claim Construction

The “bedrock principle” of patent law is that “the claims of a patent define the invention to which the patentee is entitled the right to exclude.” Phillips, 415 F.3d at 1312 (quoting Innova/Pure Water, Inc. v. Safari Water Filtration Sys. Inc., 381 F.3d 1111, 1115 (Fed. Cir. 2004)). Claim terms should be given their ordinary and customary meaning as used in the field of invention. Id. at 1312-13; Vitronics Corp. v. Conceptoronic, Inc., 90 F.3d 1576, 1582 (Fed. Cir. 1996). The ordinary and customary meaning is the meaning a claim term would have to a skilled artisan at the time of the invention - - the effective filing date of the patent application. Phillips, 415 F.3d at 1313 (citing Innova, 381 F.3d at 1116). A person of ordinary skill in the art is “deemed to read the claim term not only in the context of the particular claim in which the disputed term appears, but in the context of the entire patent, including the specification.” Id. “In some cases, the ordinary meaning of claim language . . . may be readily apparent even to lay judges, and claim construction in such cases involves little more than the application of the widely accepted meaning of commonly understood words.” Id. at 1314. A claim can depart from its ordinary meaning only if the inventor has explicitly assigned it a separate meaning. Id. at 1316.

To construe claims, a court objectively looks at public sources, such as the patent itself, its prosecution history, or technical dictionaries, that show what a skilled artisan would have understood the disputed claim language to mean. Innova, 381 F.3d at 1116. In Phillips, the Federal Circuit clarified that courts should first review the “intrinsic” record of the patent. 415 F.3d at 1314-17. Intrinsic evidence consists of the patent claims, specification, and the patent’s prosecution history. Id. at 1314; IMS Tech., Inc. v. Haas Automation Inc., 206 F.3d 1422, 1433 (Fed. Cir. 2000).

As the claims define the invention, the claim language is the most important source for a court to consider in construing the claim terms. Phillips, 415 F.3d at 1312. The second most critical source of intrinsic evidence is the patent specification, which “contain[s] a written description of the invention and of the manner and process of making and using it” 35 U.S.C. § 112 ¶ 1 (2006). The “specification ‘is always highly relevant to the claim construction analysis. Usually it is dispositive; it is the single best guide to the meaning of a disputed term.’” Phillips, 415 F.3d at 1315 (quoting Vitronics, 90 F.3d at 1582)). The third source of intrinsic evidence is the prosecution history, which consists of “the complete record of the proceedings before the Patent Office and includes the prior art cited during examination of the patent.” Id. at 1317. The prosecution history is less useful in claim construction, however, because it can itself be ambiguous as it represents ongoing negotiations between the patent applicant and the Patent

Office. *Id.*; see Inverness Med. Switz. GmbH v. Warner Lambert Co., 309 F.3d 1373, 1380-82 (Fed. Cir. 2002).

After consideration of the intrinsic evidence, if a court still finds the claim term to be ambiguous, it can look to extrinsic evidence which “consists of all evidence external to the patent and prosecution history, including expert and inventor testimony, dictionaries, and learned treatises.” Markman v. Westview Instruments, Inc., 52 F.3d 967, 980 (Fed. Cir. 1995) (en banc), *aff’d*, 517 U.S. 370 (1996). However, such external evidence is “less significant than the intrinsic record in determining the ‘legally operative meaning of claim language.’” C.R. Bard, Inc. v. U.S. Surgical Corp., 388 F.3d 858, 862 (Fed. Cir. 2004) (quoting Vanderlande Indus. Nederland BV v. Int’l Trade Comm’n, 366 F.3d 1311, 1318 (Fed. Cir. 2004)).

Legal Standards for Indefiniteness

The definiteness requirement is codified in 35 U.S.C. § 112 ¶ 2, which provides:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

35 U.S.C. § 112, ¶ 2.⁸

In Nautilus, Inc. v. Biosig Instruments, Inc., the Supreme Court set the standard for indefiniteness, holding that “a patent is invalid for indefiniteness if its claims, read in light of the specification delineating the patent, and the prosecution history, fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention.” 134 S. Ct. 2120, 2124 (2014). At the same time an inventor “need not explain every detail because a patent is read by those of skill in the art.” Wellman, Inc. v. Eastman Chem. Co., 642 F.3d 1355, 1367 (Fed. Cir. 2011). Failure to meet this definiteness requirement renders the subject claim invalid. Allen Eng’g Corp. v. Bartell Indus., Inc., 299 F.3d 1336, 1349 (Fed. Cir. 2002).

Level of Skill in the Art

Plaintiffs propose that a person of ordinary skill in the art for both the ’870 and ’258 Patents is “a person with a Bachelor’s degree in electrical engineering or its equivalent, and approximately two to three years’ experience in automotive technology and/or the design and development of

⁸ Section 112 of Title 35 of the United States Code was revised as of September 6, 2011, to designate previously undesignated paragraphs and to conform terminology to changes made in other parts of Title 35. Leahy-Smith America Invents Act, Pub. L. No. 112-29, § 4(c), 125 Stat. 284, 296 (2011). As the applications of all patents-in-suit were filed prior to September 16, 2012, the version of 35 U.S.C. § 112(2) in effect prior to the passage of the America Invents Act applies to the Court’s claim construction. *Id.* § 4(e), 125 Stat. at 297 (“The amendments made by this section shall take effect upon the expiration of the 1-year period beginning on the date of the enactment of the Act and shall apply to any patent application that is filed on or after the effective date.”).

open loop and closed loop automotive electronic systems.” Pls.’ Br. 6. Plaintiffs note that “[m]ore education could substitute for experience, and that experience, especially when combined with training, could substitute for formal college education.” Id.

Defendants argue that a person of ordinary skill in the art for the ’870 Patent is a person with “a Bachelor’s degree in electrical engineering (or four years of relevant work experience), and familiarity with the design of vehicle electrical starting systems.” Defs.’ Br. 5. For the ’258 Patent, Defendants argue that the technology is more complicated and that a person of ordinary skill in the art would have achieved:

(1) a Ph. D in electrical engineering with a focus on designing power control circuits and some familiarity with vehicle electrical systems; (2) a Master’s degree in electrical engineering, and two years of experience in designing power control circuits and some familiarity with automotive vehicle electrical systems; (3) a Bachelor’s degree in electrical engineering and four years of experience designing power control circuits and some familiarity with automotive vehicle electrical systems; or (4) some undergraduate engineering coursework including at least one introductory course [in] electrical engineering, ten years of relevant work experience including 6 years of experience designing power control circuits, and some familiarity with automotive vehicle electrical systems.

Defs.’ Br. 5.

The field of invention here is automotive electronic systems, including vehicle control systems, sensors, and actuators. Wilhelm Decl. ¶ 19. The Court agrees that the ’258 Patent is directed to more complicated circuitry technology than the ’870 Patent, but finds the parties’ definitions of a person of ordinary skill in the art to be substantially similar. Hence, for the purposes of claim construction only, the Court defines a person of ordinary skill in the art as follows:

- For the ’870 Patent, a person of ordinary skill in the art is a person with a Bachelor’s degree in electrical engineering or its equivalent with approximately three years’ experience in the design and development of vehicle electrical starting systems, with the recognition that more education could substitute for experience and experience combined with training could substitute for formal college education.
- For the ’258 Patent, a person of ordinary skill in the art is a person with a Bachelor’s degree in electrical engineering with approximately four years’ experience designing power control circuits and some familiarity with automotive vehicle electrical control systems, including open loop and closed loop automotive electrical systems, with the recognition that more education could substitute for experience and experience combined with training could substitute for formal college education.

Effective Filing Date

The ’870 Patent and the ’258 Patent both list related Application number 07/785,462 filed October 31, 1991, now abandoned, as their earliest possible priority application date. As such, the

Court considers the effective filing date of the '870 and '258 Patents to be October 31, 1991, for the purposes of claim construction.

Claim Construction of the '870 Patent

“located within said housing at a location remote from”

The parties dispute whether the term “remote” in Claim 9 of the '870 Patent conveys with reasonable certainty the location of the power supply circuitry relative to the temperature sensor to a person of ordinary skill in the art. The parties' dispute centers on the word “remote” within the term “power located within said housing at a location remote from said temperature sensor.”

Claim 9 is dependent on Claim 1, and states:

1. A glow plug controller comprising:
 - a) a generally tubular housing having a wall defining a first chamber and a second chamber and a second chamber communicating with said first chamber, the portion of the outer surface of the wall which defines said first chamber being a threaded portion for threaded engagement in hole;
 - b) glow plug controller circuitry including a temperature sensor located within said threaded portion and circuitry for controlling glow plug operation as a function of sensed temperature, said temperature sensor being located within said first chamber and wherein glow plug controller circuitry is located within said second chamber of said housing; and
 - c) means for conductively coupling said glow plug controller circuitry to other circuitry external to said housing.

* * *

9. The glow plug controller of Claim 1, wherein:
 - a) said glow plug controller circuitry comprises power supply circuitry, and
 - b) said power supply circuitry is located within said housing at a location remote from said temperature sensor.

'870 Patent 10:43-60, 11:23-28.

The parties propose the following constructions of “remote”:

Plaintiffs' Proposed Construction	Defendants' Proposed Construction
no construction needed	indefinite
Pls.' Suppl. Br. 7.	Defs.' Suppl. Br. 1.

Defendants argue the term “remote” is indefinite and thus invalid because a person of ordinary skill “cannot ascertain with any certainty” where the power supply circuitry is located in

the second chamber relative to the temperature sensor based on the “lack of guidance in the patent regarding the term ‘remote.’” Defs.’ Br. 9. As definiteness is a condition of patentability, Defendants have the burden of showing Claim 9 is indefinite by clear and convincing evidence. Nautilus, Inc. v. Biosig Instruments, Inc., 783 F.3d 1374, 1377 (Fed. Cir. 2015).

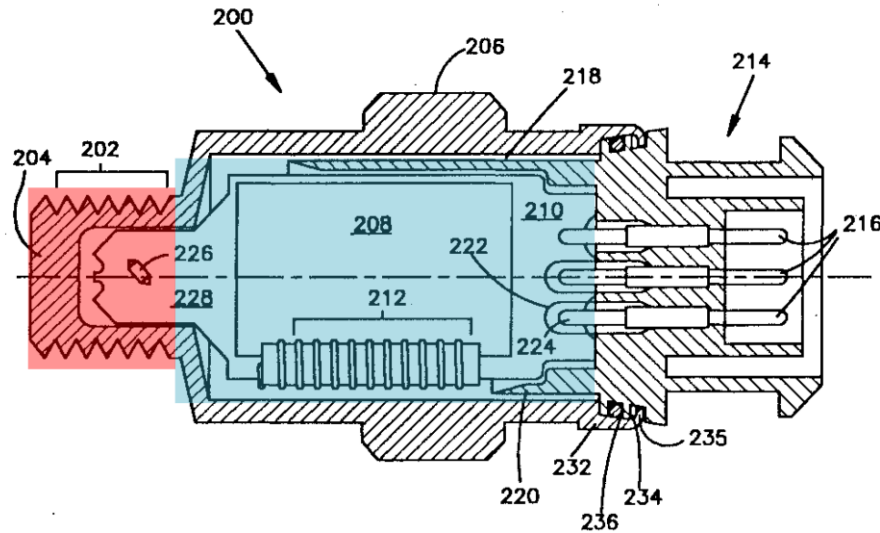
Plaintiffs counter that the term “remote” as it appears in “Claim 9 allows the power supply circuitry to be located anywhere in the second chamber” of the tubular housing. Pls.’ Br. 17. Plaintiffs continue that a person of ordinary skill in the art would understand Claim 9 to mean that some “separation between the power supply circuitry and the temperature sensor would be desirable as a matter of design.” Id. at 15. Plaintiffs assert that because “the temperature sensor should be as close as possible to the temperature source,” a person of ordinary skill in the art “would know that the power supply circuitry should be separated from the temperature source so that the power supply doesn’t cause the temperature sensor to generate false signals” Id. at 15; Tr. 89.

Here, the term “remote” is a term of degree, i.e., a relative term of measurement rather than an objective term of measurement, as the claims do not provide an exact unit of distance between the power supply circuitry in the second housing chamber and the temperature sensor. See also Interval Licensing LLC v. AOL, Inc., 766 F.3d 1364, 1371 (Fed. Cir. 2014). Terms of degree can be “problematic if their baseline is unclear to those of ordinary skill in the art,” but such terms are not “inherently indefinite.” Liberty Ammunition, Inc. v. United States, 835 F.3d 1388, 1395-96 (Fed. Cir. 2016). However, “claims having terms of degree will fail for indefiniteness unless they ‘provide objective boundaries for those of skill in the art’ when read in light of the specification and prosecution history.” Id. at 1396 (quoting Interval Licensing, 766 F.3d at 1370-71).

Intrinsic Evidence

Claim 1 expressly requires the temperature sensor to be located in the first chamber and the glow plug controller circuitry to be located in the second chamber of the glow plug controller housing. ’870 Patent 10:53-57 (“[S]aid temperature sensor being located within said first chamber, and wherein glow plug controller circuitry is located within said second chamber of said housing”). Claim 9 adds the limitations that the glow plug controller circuitry located in the second chamber “comprises power supply circuitry” and that “said power supply circuitry is located within said housing at a location remote from said temperature sensor.” ’870 Patent 11:23-28. The claims are silent, however, as to the precise location of the power supply circuitry within the second chamber relative to the temperature sensor. Where the claims are silent, the specification guides. See Liberty Ammunition, 835 F.3d at 1396.

Figure 4a in the ’870 Patent depicts the glow plug controller housing claimed in the ’870 Patent, with the first housing chamber depicted in the red threaded portion 202, and the second chamber depicted in blue and extending from the area past the threaded portion to the end of circuit board 210:

**Fig.4A**

PDX 1 at 27; '870 Patent Fig. 4a (depicting the “mechanical configuration” of the glow plug controller as a “cylindrical aluminum housing 200” having a “threaded portion 202 near its left end.”); '870 Patent 9:15-20. The housing contains a temperature sensor 226 in the threaded first chamber, while the glow plug controller circuitry, on circuit boards 210 and 208, is located in the second blue chamber. '870 Patent 10:50-57.

The Specification further describes Figure 4:

Among the circuitry borne by the circuit board 210 is a thermistor 226 which corresponds to the [negative temperature coefficient] temperature sensor described above. The thermistor 226 is located at the forward, or left hand, end of the board 210, on a protrusion 228 defined by the circuit board 210 and extending into the hollow smaller chamber defined within the threaded portion 202 of the housing 200.

'870 Patent 9:53-59.

As with the claim language, the Specification describes the temperature sensor 226 to be in the first housing chamber indicated by the threaded portion 202 of the controller. '870 Patent 3:33-36 (“The temperature sensor itself is located within the smaller first chamber, while other glow plug circuitry is located in the larger second chamber.”). '870 Patent 9:53-59. The Specification suggests placing the temperature sensor as close to the engine as possible, exposing it to the engine coolant, so that the temperature sensor can obtain accurate readings to enhance glow plug controller operation:

In use, the glow plug controller, including a thermistor temperature sensor, is mounted in a threaded hole (not shown) in the engine block of the vehicle, near a portion of the water jacket of the engine. The hexagonal portion facilitates tightening of the housing containing the glow plug controller circuitry into the engine block by use of an appropriate tool. The hole (not shown) can actually

penetrate the block, such that the end 204 of the housing is directly exposed to the engine coolant.

* * *

The glow plug controller circuitry, contained within the housing which is in turn threaded in the engine block near a water jacket, utilizes direct engine mounting for facilitating temperature sensing of engine coolant temperature for enhancing accuracy in such temperature sensing and in the attendant glow plug control.

'870 Patent 9:21-29, 10:20-26 (emphasis added).

The Specification would thus lead a person of ordinary skill in the art to construct a glow plug controller design that maximizes the ability of the temperature sensor to obtain accurate readings of the engine coolant temperature. However, the Specification does not direct via precise mathematical units of distance where a person of ordinary skill in the art would place the power supply circuitry in the second chamber of the glow plug controller housing relative to the temperature sensor. The Court therefore finds extrinsic evidence necessary to construe the term "remote" in the context of the '870 Patent. See Verve, LLC v. Crane Cams, Inc., 311 F.3d 1116, 1119-20 (Fed. Cir. 2002) (requiring a trial court to consider extrinsic evidence if a claim term cannot be construed based on intrinsic evidence alone and the accused infringer argues the claim is indefinite); see also Advanced Cardiovascular Sys. v. Scimed Life Sys., Inc., 261 F.3d 1329, 1344 (Fed. Cir. 2001).

Extrinsic Evidence

The parties' expert testimony sheds light on how a person of ordinary skill in the art would understand the term "remote" as a measure of distance. Phillips, 415 F.3d at 1318 ("[E]xtrinsic evidence in the form of expert testimony can be useful to a court . . . to ensure that the court's understanding of the technical aspects of the patent is consistent with that of a person of skill in the art . . ."). Both parties provided expert reports on claim construction and excerpts from the transcripts of the experts' depositions.

Plaintiffs' expert, Dr. Ralph V. Wilhelm,⁹ relying on Figure 4A, testified that

⁹ Plaintiffs' expert Dr. Ralph V. Wilhelm is the founder and President of Wilhelm Associates, LLC, an independent consulting firm that specializes in automotive electronics, engine control electronics, telematics, infotainment, safety systems, systems engineering, data communications between systems and devices, and product/market and business strategies. Wilhelm Decl. ¶ 3. He has 44 years of industrial and consulting experience in Automotive Electronics Research, Development and Engineering. Id. at ¶ 19. Dr. Wilhelm received a Bachelor of Science in Electrical Engineering in 1967, and a Ph.D. in Ceramic Engineering/Material Science from Rutgers University in 1972. Id. at ¶ 5. He has authored dozens of published technical papers addressing various aspects of automotive electronic systems and holds three U.S. patents directed to methods of constructing automotive sensors. Id. at ¶ 6. Prior to starting his consulting firm, Dr. Wilhelm worked as a research scientist for General Motors Research Laboratories and was the

[C]ommon sense wouldn't tell you to [locate the power supply circuitry and the thermistor right next to each other] . . . I believe that - - that a person of ordinary skill in the art would not put a thermistor that's intending to measure temperature of a fluid outside of this thread next to a power supply that's going to generate heat and give false signals [The best way to locate the temperature sensor remote from power supply circuitry is] to put the thermistor closest to the - - the engine temperature, the fluid, and to put the power supply further away from that so that it approaches the connector pins number 224 and 222 [in Figure 4A].

Wilhelm Dep. 115-18.

The Court finds Dr. Wilhelm's deposition testimony persuasive as it provides a common-sense rationale for why a person of ordinary skill in the art would not want to place the power supply circuitry next to the temperature sensor - - the power supply circuitry would generate heat and thus produce false temperature readings. Wilhelm Dep. 115-18.

In contrast, Defendants' expert Mr. John D. Loud opined that the meaning of "remote" is unclear.¹⁰ Mr. Loud testified with respect to Figure 4A:

As an engineer of ordinary skill in the art, it's my job to evaluate what's claimed in the context of some hypothetical product that I'm building. So I'm going to build a product and I need to put a power supply in there, and I know I've got a thermistor, and to know whether or not I have designed something that's within the scope of what's claimed, I need to understand what the term "remote" means, and in this context, I don't understand when I am within the scope of the claim or not because it's not clearly outlined for me to know.

Loud Dep. 103.

Mr. Loud opined that the '870 Patent itself "provides no explanation for the advantage of placing the power supply circuitry 'at a location remote from said temperature sensor'" and that a

Department Head of Materials Development for General Motors Corporation's AC Spark Plug Division. From 1984-2001, Dr. Wilhelm worked in various capacities for Delphi Delco Electronics Corporation. Id. at ¶¶ 12-15. He has received numerous professional awards for his work and is actively involved in many professional organizations including the Society of Automotive Engineers, the Institute of Electrical and Electronic Engineers, Sigma Xi, the Accreditation Board for Engineering and Technology, and the Society for Information Display. Id. at ¶ 17.

¹⁰ Defendants' expert Mr. John D. Loud is a Principal Engineer at Exponent Inc. Loud Decl. ¶ 4. Mr. Loud received a Master of Science in Electrical Engineering from San Jose State University in 1995. Id. at ¶ 6. During his studies, Mr. Loud designed and built a working prototype of a portion of the power control circuitry for General Electric Nuclear and a working prototype of the "next generation motor controller" for the Bradley Fighting Vehicle that uses a diesel engine. Id. Mr. Loud designed and constructed power control circuitry to control and operate both the generator and propulsion induction machines of the Bradley Fighting Vehicle. Id.

person of ordinary skill in the art “would have been unable to ascertain what is meant by that term.” See Loud Decl. ¶ 87. Mr. Loud failed to consider intrinsic evidence from the perspective of the person of ordinary skill in the art - - a person with a Bachelor’s degree in electrical engineering with multiple years of experience in automotive vehicle starting systems. Nautilus, 134 S. Ct. at 2128-29 (“One must bear in mind, moreover, that patents are ‘not addressed to lawyers, or even the public generally,’ but rather to those in the relevant art.” (quoting Carnegie Steel Co. v. Cambria Iron Co., 185 U.S. 403, 437 (1902))). As Dr. Wilhelm recognized, the intrinsic evidence in the Specification expressly recognizes the need for the temperature sensor to have accurate readings. ’870 Patent 10:20-26. This express goal in the Specification aligns with Dr. Wilhelm’s testimony that a person of ordinary skill in the art would place the power supply circuitry closer to pins 222 and 224 than to temperature sensor 226. Wilhelm Dep. 117-18. In contrast, Defendants point to no intrinsic evidence that would suggest that a person of ordinary skill in the art would be inclined to place the power supply circuitry near the temperature sensor, or at some random location that would not take into account the temperature of the power supply circuitry vis-à-vis the temperature sensor.

A claim is only considered indefinite if, when “read in light of the specification delineating the patent, and the prosecution history, [it] fail[s] to inform, with reasonable certainty, those skilled in the art about the scope of the invention.” Nautilus, 134 S. Ct. at 2124. Defendants demand a degree of certainty from the patent beyond what is reasonable for the sophisticated person of ordinary skill in the art here. Claim 9, the Specification, and the extrinsic evidence make clear that the power supply circuitry is located in the constrained space of the second chamber of the glow plug controller housing and at a location “remote” - - i.e., at a distance - - from the temperature sensor such that the temperature sensor does not get false readings from the power supply circuitry.

In sum, the Court finds that, based on Dr. Wilhelm’s testimony, a person of ordinary skill in the art would, with reasonable certainty, be able to make an “informed and confident choice” from the claims and Specification to place the power supply circuitry at a distance from the temperature sensor within the constrained system of the second chamber of the glow plug controller housing based on the term “remote” as it appears in Claim 9 of the ’870 Patent. As such, no further construction is necessary. See Media Rights Techs., Inc. v. Capital One Fin. Corp., 800 F.3d 1366, 1371 (Fed. Cir. 2015) (quoting Nautilus, 134 S. Ct. at 2130 n.8); see also Cloud Farm Assocs., L.P. v. Volkswagen Grp. of Am., No. 10-502-LPS, 2015 WL 4730898, at *3-4 (D. Del. Aug. 10, 2015) (construing “remotely” to mean “at a distance” according to its plain ordinary meaning based on intrinsic evidence), aff’d on other grounds, No. 2016-1448, 2017 WL 74768 (Fed. Cir. Jan. 9, 2017) (affirming a stipulated judgment following claim construction).

Claim Construction of the ’258 Patent

“a voltage signals”

The parties dispute the construction of the term “a voltage signals” as it appears in Claim 9 which depends on Claim 1 of the ’258 Patent:

1. For use with a motor vehicle diesel engine having one or more glowplugs for maintaining temperature control of one or more diesel engine combustion chambers, apparatus comprising . . .

- c) A programmable controller supported within the housing interior that is coupled to the monitor circuitry and produces a control output for supplying energy to the glowplugs;
- d) at least one switching device supported within the housing interior that is coupled to the control output from the programmable controller for energizing the one or more glow plugs in a controlled time sequence prior to, during an/or^[11] after engine cranking by selectively coupling the energization signals to the glow-plugs;

* * *

9. The apparatus of claim 1 wherein the programmable controller comprises a microprocessor and further wherein analog signals routed into the housing representing a voltage signals from the power source are performed by the microprocessor.

'258 Patent 23:33-36, 45-48; 24:50-55 (emphasis added).

The parties propose the following constructions for “a voltage signals”:

Plaintiffs' Proposed Construction	Defendants' Proposed Construction
voltage signals	Indefinite
Pls.' Br. 10	Defs.' Br. 19.

Plaintiffs rely upon the limitation in Claim 9 stating “a microprocessor and further wherein analog signals routed into the housing representing a voltage signals from the power source are performed by the microprocessor.” Pls.' Br. 10 (emphasis added). Plaintiffs argue that because “‘analog signals’ is plural in this limitation . . . a person of ordinary skill in the art would understand that ‘voltage signals’ should be plural as a result.” *Id.* Defendants argue that the “correction of the grammatical error(s) is subject to reasonable debate” and that the Court “does not have the authority to rewrite the claim.” Defs.' Br. 19 (relying on Novo Indus., L.P. v. Micro Molds Corp., 350 F.3d 1348, 1354 (Fed. Cir. 2003)). Here, the parties do not dispute that the term “a voltage signals” is grammatically incorrect on its face because the addition of “a” indicates that the term is singular, while “signals” is plural. The issue before the Court is whether to construe “a voltage signals” to mean “a voltage signal,” “voltage signals,” or to conclude that the term is indefinite.

“It is well-settled law that, in a patent infringement suit, a [trial] court may correct an obvious error in a patent claim.” CBT Flint Partners, LLC v. Return Path, Inc., 654 F.3d 1353, 1358 (Fed. Cir. 2011) (citing I.T.S. Rubber Co. v. Essex Rubber Co., 272 U.S. 429, 442 (1926)); Novo, 350 F.3d at 1354. In Novo, the Federal Circuit held that a trial court may correct grammatical errors in a patent if: 1) the correction is not subject to reasonable debate based on

¹¹ As noted above, the parties stipulated to the construction of the term “an/or” to mean “and/or.”

consideration of the claim language and specification and 2) the prosecution history does not suggest a different interpretation of the claims. 350 F.3d at 1354. In CBT Flint, the Federal Circuit clarified that, where multiple ways to correct a grammatical error are possible, the court must “consider those alternatives from the point of view of one skilled in the art” and must “consider how a potential correction would impact the scope of a claim and if the inventor is entitled to the resulting claim scope based on the written description of the patent.” 654 F.3d at 1359. If correcting a grammatical error in a claim term would be “substantively significant and require[] guesswork as to what was intended by the patentee in order to make sense of the patent claim,” the court will not correct the grammatical error. Id. at 1358. This is because the claim would fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention and would thus be indefinite. See Nautilus, 134 S. Ct. at 2124; CBT Flint, 654 F.3d at 1358; Novo, 350 F.3d at 1358.

Intrinsic Evidence

When dealing with “mixed use of singular and plural language,” which is a recognized source of “likely ambiguity,” the Federal Circuit has emphasized the “need for context-based interpretation.” Atlas IP, LLC v. Medtronic, Inc., 809 F.3d 599, 608-09 (Fed. Cir. 2015) (citing Robert C. Faber, Faber on Mechanics of Patent Claim Drafting § 3:11 (7th ed. 2015)). In Atlas, the Federal Circuit cautioned trial courts not to rely exclusively on “claim words understood in isolation” but to widen the analysis to look at what the “claim language requires.” Id. at 609. Here, Claim 9 requires the Court to understand the relationships between the analog signals, the voltage signal or signals, and the power source.

The Court looks first to the claims as they “define the invention to which the patentee is entitled the right to exclude.” Phillips, 415 F.3d at 1312 (quoting Innova, 381 F.3d at 1115). Here, Independent Claim 1, from which Claim 9 depends, provides context in claiming that the programmable controller “produces a control output for supplying energy to the glowplugs.” Energy is supplied to the glow plugs as a result of the “control output” because the programmable controller is coupled to at least one switching device that energizes “one or more glow plugs in a controlled time sequence.” ’258 Patent 23:33-36, 45-48. Claim 9 provides for this “control output” to be performed by a microprocessor. The claim states that “the programmable controller comprises a microprocessor and further wherein analog signals routed into the housing representing a voltage signals from the power source are performed by the microprocessor.” ’258 Patent 24:50-54. As such, when Claims 1 and 9 are read together, it becomes clear that the programmable controller in Claim 9 is directed to a microprocessor that produces a “control output” to signal whether glow plug energization is needed based on voltage as determined by the glow plug’s power source. In other words, Claim 9 recites a microprocessor that turns voltage measurements into analog signals as a way to determine if the glow plugs require energy.

The ’258 Specification clarifies, and the parties do not dispute, that the term “a voltage signals” refers to “glow plug operating voltage.” ’258 Patent 16:64-67. The ’258 Specification then explicitly defines a single “glow plug energization voltage signal” to be “measured using analog to digital conversion (ADC) as a scaled down signal from at least one of various nodes including battery and the power relay terminal connected directly to the glow plug(s).” ’258 Patent 7:52-55. Each individual glow plug produces its own “glow plug energization voltage signal.” ’258 Patent 7:52-55.

To that effect, the '258 Specification explains that the glow plugs in the '258 Patent are to be powered individually, resulting in individual glow plug voltage measurements:

Switching power to each glow plug independently allows for practical application of multiple solid state switches Multiple switches allow improved input measurement and output control of each individual glow plug or group thereof including such independent functions as [t]emperature measurement, voltage measurement, current measurement, energization, deenergization, disabling due to excessive current and/or short circuit condition, disabling due to excessive temperature of switch and/or glow plug, monitoring and diagnostics of glow plug voltages and/or currents, and specific control of switching on and off of individual glow plugs or groups thereof at differing times for reduction of related switching transients and peak load dump magnitudes.

'258 Patent 10:52-53, 10:61-11:5.

As voltage is an “independent function” of “each individual glow plug,” a diesel engine containing multiple glow plugs would have multiple voltage measurements to be received by the programmable controller - - the microprocessor in Claim 9. The person of ordinary skill in the art here, an engineer with approximately four years of experience in power control circuits, would recognize that each glow plug produces its own voltage signal and that there are multiple glow plugs in the diesel engine system, leading to the clear conclusion that there are multiple “voltage signals.” As such, the intrinsic evidence makes clear to a person of ordinary skill in the art that “a voltage signals” should be construed as “voltage signals” in the context of the '258 Patent whose claims are directed to vehicles with “one or more glow plugs.”¹² See '258 Patent 23:33-36.

Defendants argue that because the '258 Patent's prosecution history does not “suggest whether the applicants intended ‘a voltage signals’ to be singular or plural,” this history dictates that the Court should not correct “a voltage signals.” However, a prosecution history that is silent on a claim term does not prevent a court from correcting a grammatical error. See Novo, 350 F.3d at 1354 (holding that a court can correct a patent claim for a grammatical error where the prosecution history does not “suggest a different interpretation of the claims”). Because the Court finds that this interpretation is not subject to reasonable debate and the available prosecution history does not suggest otherwise, the Court corrects this facially apparent grammatical error and construes “a voltage signal” to mean “voltage signals.” See id.

Defendants argue that the PTAB's Institution Decision should be considered intrinsic evidence as part of the prosecution history of the '258 Patent. Defendants continue that the PTAB's Institution Decision is “compelling evidence that the term is indefinite.” Defs.' IPR Br.

¹² Dependent Claim 26, like Dependent Claim 9, is directed to the “programmable controller” of Claim 1, and claims an operating system to adjust glow plug energization based on one or more “sensed conditions” including “glow plug voltage(s).” '258 Patent 25:55-64. As such, Claim 26 supports interpreting “a voltage signals” to be “voltage signals” - - as each glow plug has an individual voltage reading, yielding multiple voltage measurements to be received by the microprocessor.

5 (ECF No. 218) (citations omitted). However, the PTAB's Institution Decision is only preliminary and did not have any input from the patent owner. Plaintiff UUSI did not offer any construction of "a voltage signals" to the PTAB in support of its construction of "a voltage signals," as it did before this Court. Instead, Plaintiff UUSI reserved its right "to offer constructions of the limitations in the dependent claims should the Board decide to institute the Petition." Institution Decision 14 n.9. Plaintiff UUSI's choice to abstain from proffering evidence in support of its construction before the PTAB undermines the persuasive weight of the PTAB's construction of "a voltage signals" before this Court. See SkyHawke Techs., LLC v. Deca Int'l Corp., 828 F.3d 1373, 1376 (Fed. Cir. 2016) (holding that the PTAB's claim construction decision was not binding on the trial court, in part because "issue preclusion requires that 'the issues were actually litigated' by the parties." (quoting In re Trans Tex. Holdings Corp., 498 F.3d 1290, 1297 (Fed. Cir. 2007))).

"power correction after removal or an ignition signal"

The parties dispute the term "power correction after removal or an ignition signal" as it appears in Claim 1 of the '258 Patent:

1. For use with a motor vehicle diesel engine having one or more glowplugs for maintaining temperature control of one or more diesel engine combustion chambers, apparatus comprising:

* * *

- e) load protection circuitry supported within the housing interior for temporarily maintaining an alternator to battery power correction after removal or an ignition signal until engine speed has been reduced to a specified value.

'258 Patent 23:33-36, 56-60.

The parties propose the following constructions for "power correction after removal or an ignition signal":

Plaintiffs' Proposed Construction	Defendants' Proposed Construction
power connection after removal of an ignition signal Pls.' Br. 7	indefinite; Alternatively: power correction after removal or an ignition signal Def.' Br. 14

Plaintiffs argue that the term "power correction after removal or an ignition signal" contains two typographical errors: 1) "correction" should be construed as "connection," and 2) "or" should be construed as "of." Pls.' Br. 7. Defendants counter that "there is a reasonable debate as to how Claim 1 should be corrected" and that "[t]o the extent that the Court determines that the

Claim is not indefinite, the claim should be construed consistent with its original scope to mean ‘power correction after removal or an ignition signal.’” Defs.’ Br. 15.

As with the term “a voltage signals,” a court looks to the two-part test outlined in Novo, which authorizes a court to correct typographical errors in a patent if: 1) the correction is not subject to reasonable debate based on consideration of the claim language and specification and 2) the prosecution history does not suggest a different interpretation of the claims. 350 F.3d at 1354. This two-part test is applied from the point of view of a person of ordinary skill in the art and considers “how a potential correction would impact the scope of a claim and if the inventor is entitled to the resulting claim scope.” CBT Flint, 654 F.3d at 1359. If, after applying Novo and CBT Flint, the court is unable to reach a construction based on conflicting reasonable interpretations and the claim “fail[s] to inform, with reasonable certainty, those skilled in the art about the scope of the invention,” the claim would be considered indefinite and thus invalid. See Nautilus, 134 S. Ct. at 2124; Novo, 350 F.3d at 1358.

Intrinsic Evidence

The part of the apparatus in Claim 1 at issue here is the “load protection circuitry” which is used to prevent any damage to the vehicle by reducing voltage spikes that would otherwise harm vehicle components. See ’258 Patent 11:26-36. Independent Claim 48, which is directed to a method of starting the diesel engine, mirrors Claim 1’s apparatus, stating:

48. For use with a motor vehicle diesel engine having one or more glowplugs for maintaining temperature control of one or more diesel engine combustion chambers, a method of starting the diesel engine comprising the steps of:

* * *

f) temporarily maintaining alternator to battery power connection after removal of an ignition signal until engine speed has been reduced to a specific value.

’258 Patent 28:6-9, 27-29. In other words, because Claim 48 is a method that corresponds to the apparatus in Claim 1, a person of ordinary skill in the art would look to Claim 48 to interpret Claim 1. Claim 48 uses the exact phrase “power connection after removal of an ignition signal” without the typographical errors in Claim 1. As such, a person of ordinary skill in the art looking at Claim 1 would consider Claim 48 and be led to understand the term “power correction after removal or an ignition signal” to be “power connection after removal of an ignition signal.”

The ’258 Specification provides further dispositive support that the term “power correction after removal or ignition signals” in Claim 1 should be construed as “power connection after removal of an ignition signal.” In particular, the Specification describes why the battery-to-alternator power connection should be delayed to prevent voltage spikes and harm to the engine:

In accordance with the invention, high voltage spikes, whether from glow plug or other load dump, has been very significantly reduced by latching on the load dump control relay and monitoring engine speed via the alternating voltage signal produced at the alternator field R tap and delaying battery to alternator electrical

connection unlatching until after the alternator is sufficiently reduced in speed such that all alternator sourced load currents are reduced below that level which can cause any significant harm by load dumping.

'258 Patent 4:38-46. The Specification further highlights that the load protection circuitry aims to protect "various vehicle components" by reducing voltage spikes that could occur when the alternator to battery connection - - not correction - - is disconnected after the ignition is switched off, or removed. See '258 Patent 11:50-56 ("Many electrical loads are connected to the alternator output so that when the battery connection to the alternator is dropped out immediately when the ignition key switch is changed from the RUN position to the OFF position the integral voltage regulator within the alternator can continue significant output load current." (emphasis added)); 12:16-21 ("An optional method to control load dump induced voltage spikes is to hold the alternator-to-battery power connection for a short period after the ignition key is switched to the off position while immediately dropping out the glow plug load so as to remove the glow plug load dump from being sourced solely by the alternator." (emphasis added)); see also '258 Patent 11:26-36 (describing the need to "disconnect the alternator to battery connection and/or to deenergize the glow plugs so as to reduce the potentially damaging and dangerous voltage spike generated by instantaneous disconnection of high glow plug and/or other vehicle currents through the inductive coils of the alternator." (emphasis added)). In contrast to the repeated references to "power connection," the term "power correction" does not appear in the '258 Patent aside from Claim 1.

Defendants argue, however, that the prosecution history of the '258 Patent "suggests that the inclusion of the term "power correction after removal or an ignition signal" was not an error because the applicants "specifically amended the claim to add the term 'power correction after removal or an ignition signal.'" Defs.' Br. 18. Plaintiffs counter that this inclusion during claim amendments in the prosecution history only indicates that the "typographical error that is present in the current claim was also present when originally drafted." Pls.' Reply 5. The Court agrees with Plaintiffs that this error, which first appeared in the prosecution history, was carried through in the issuance of the '258 Patent. The uninformative prosecution history only suggests that the typographical error occurred - - not that the term "power correction after removal or an ignition signal" was intentional in the context of the amendment.

Based on the ample intrinsic evidence in the claim language and Specification, the Court construes the term "power correction after removal or an ignition signal," as it appears in Claim 1 of the '258 Patent to mean "power connection after removal of an ignition signal."

"until"

The parties dispute the term "until" as it appears in the "load protection circuitry" limitation in Claim 1 of the '258 Patent:

- e) load protection circuitry supported within the housing interior for temporarily maintaining an alternator to battery power [connection] after removal [of] an ignition signal until engine speed has been reduced to a specified value.

'258 Patent 23:56-60.¹³

The parties propose the following constructions of “until”:

Plaintiffs' Proposed Construction	Defendants' Proposed Construction
no construction needed Pls.' Br. 29.	up to the point, but not thereafter Defs.' Br. 29.

Plaintiffs argue that the term “until” requires no construction and that Defendants’ proposed construction “does not appear in the ’258 Patent at all.” Pls.’ Br. 29. Plaintiffs contend that the term “until” permits the load protection circuitry to continue to temporarily maintain the “alternator to battery power connection” after “engine speed has been reduced to a specified value.” Plaintiffs posit that “Defendants appear to be reading an immediacy into the claims that is not otherwise present and also suggesting that certain actions could not reoccur” and that “[b]oth of these additional limitations do not appear in the claim as written.” *Id.* Defendants counter that their proposed construction embraces the ordinary and customary meaning of the term “until” by making clear that “when engine speed has been reduced to the required specified value,” the action of “temporarily maintaining an alternator to battery power [connection]” ceases. Defs.’ Br. 30.

As the meaning of the term “until” in the context of the ’258 Patent is subject to dispute, the Court finds claim construction necessary. O2 Micro Int’l, Ltd. v. Beyond Innovation Tech. Co., 521 F.3d 1351, 1361 (Fed. Cir. 2008) (“A determination that a claim term ‘needs no construction’ or has the ‘plain and ordinary meaning’ may be inadequate when a term has more than one ‘ordinary’ meaning or when reliance on a term’s ‘ordinary’ meaning does not resolve the parties’ dispute.”); see Eon Corp. IP Holdings v. Silver Spring Networks, 815 F.3d 1314, 1318-19 (Fed. Cir. 2016) (“[A trial] court’s duty at the claim construction stage is, simply, . . . to resolve a dispute about claim scope that has been raised by the parties.”).

Intrinsic Evidence

The parties do not rely on the claim language itself in their proposed constructions. Rather, Plaintiffs maintain that no construction is necessary, while Defendants cite the Specification. Because the Specification describes how the load protection circuitry in Claim 1 operates and thereby illuminates the meaning of “until” in the context of the ’258 Patent, the Specification is highly relevant. The Specification states:

In accordance with the invention, high voltage spikes, whether from glow plug or other load dump, [have] been very significantly reduced by latching on the load dump control relay and monitoring engine speed via the alternating voltage signal

¹³ As discussed above, the Court construed “power correction” to mean “power connection” and “or” to mean “of” and applies that construction here.

produced at the alternator field R tap¹⁴ and delaying battery to alternator electrical connection unlatching until after the alternator is sufficiently reduced in speed such that all alternator sourced load currents are reduced below that level which can cause any significant harm by load dumping.

'258 Patent 4:39-46 (emphasis added).

The '258 Specification is precise in stating that this delay in “unlatching” permits the glow plugs to deenergize before disconnecting “the alternator to battery connection” so as to reduce the potentially damaging and dangerous voltage spikes generated by instantaneous discontinuation of “high glow plug and/or other vehicle currents through the inductive coils of the alternator.” '258 Patent 11:32-37. In other words, the reduction in engine speed acts to discontinue the transfer of energy from the engine to the alternator at the moment when engine speed is reduced to that specified value in order to prevent damage to the vehicle. See '258 Patent 11:32-37. The phrase “a specified value” indicates that the unlatching process is automatic when engine speed is reduced to that “specified value.” By recognizing that a reduction in engine speed “to a specified value” controls the timing of disconnecting the alternator to battery power connection, Defendants’ construction is supported by the Specification.

In contrast, Plaintiffs’ understanding of the meaning of the term “until,” i.e., disconnecting the alternator to battery power connection at some unspecified time after the engine speed is reduced below a “specified value,” runs counter to the Specification. '258 Patent 11:32-37. Nothing in the Specification supports finding that the “specified value” is subject to change. Nor does the Specification suggest that the claimed action of “temporarily maintaining an alternator to battery connection” could continue after the “specified value” speed has been reached.

In view of the intrinsic evidence that squarely supports Defendants’ proposed construction, the Court construes the term “until” as it appears in Claim 1 of the '258 Patent to mean “up to the point, but not thereafter.”

“means based on various sensed conditions to adjust to a preglow energization time and an afterglow energization time to limit excessive temperatures of the glow plugs while applying adequate glow plug energy to facilitate engine starting and warmup”

The parties dispute the construction of this term but agree that this term is a means-plus-function claim as it “includes functional language, utilizes the word ‘means,’ and does not convey corresponding structure in the claim itself.” Pls.’ Br. 17-18; Defs.’ Br. 31-32. As such, the term is governed by 35 U.S.C. § 112, ¶ 6, which states:

An element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof.

¹⁴ The R tap is a switch that begins and ends the transmission of energy to the alternator, a device that reenergizes a vehicle battery after combustion begins.

35 U.S.C. § 112, ¶ 6 (2006).

Section 112, ¶ 6 statutorily limits the function claimed to the means - - or structures - - described in the patent specification. Al-Site Corp. v. VSI Int'l, Inc., 174 F.3d 1308, 1320 (Fed. Cir. 1999) (“Section 112, ¶ 6 recites a mandatory procedure for interpreting the meaning of a means- or step-plus-function claim element . . . [that] restrict a functional claim element’s ‘broad literal language . . . to those means that are equivalent to the actual means shown in the specification.’” (quoting Warner-Jenkinson Co. v. Hilton Davis Chem. Co., 520 U.S. 17, 28 (1997))). Section 112, ¶ 6 is therefore considered a “quid pro quo” in which “Congress struck a balance in allowing patentees to express a claim limitation by reciting a function to be performed . . . while placing specific constraints on how such a limitation is to be construed, namely by restricting the scope of coverage to only the structure, materials, or acts described in the specification as corresponding to the claimed function and equivalents thereof.” Williamson v. Citrix Online, LLC, 792 F.3d 1339, 1347-48 (Fed. Cir. 2015) (en banc) (citing Northrop Grumman Corp. v. Intel Corp., 325 F.3d 1346, 1350 (Fed. Cir. 2003)).

To adhere to this statutory quid pro quo, the Federal Circuit outlined a two-step procedure for construing means-plus-function claim terms, directing a trial court to: 1) determine the claimed function, and 2) identify the corresponding structure in the written description that performs the claimed function. JVW Enters., Inc. v. Interact Accessories, Inc., 424 F.3d 1324, 1330 (Fed. Cir. 2005) (citing Omega Eng'g, Inc. v. Raytek Corp., 334 F.3d 1314, 1321 (Fed. Cir. 2003)); see Ibormeith IP, LLC v. Mercedes-Benz USA, LLC, 732 F.3d 1376, 1379 (Fed. Cir. 2013) (“The price of using this [means-plus-function] form of claim, however, is that the claim be tied to a structure defined with sufficient particularity in the specification.”).

The parties dispute the term in Claim 29, “means based on various sensed conditions to adjust to a preglow energization time and an afterglow energization time to limit excessive temperatures of the glow plugs while applying adequate glow plug energy to facilitate engine starting and warmup.” Claim 29 depends on Claim 1:

1. For use with a motor vehicle diesel engine having one or more glowplugs for maintaining temperature control of one or more diesel engine combustion chambers, apparatus comprising . . .
 - c) A programmable controller supported within the housing interior that is coupled to the monitor circuitry and produces a control output for supplying energy to the glowplugs;

* * *

29. The apparatus of claim 1 wherein the programmable controller comprises means based upon various sensed conditions to adjust a preglow energization time and an afterglow energization time to limit excessive temperatures of the glow plugs while applying adequate glow plug energy to facilitate engine starting and warmup.

'258 Patent 23:33-36, 23:45-48, 26:11-16 (emphasis added).

The parties propose the following constructions:

Plaintiffs' Proposed Construction	Defendants' Proposed Construction
<p>Function: Adjusting a preglow energization time and an afterglow energization time to limit excessive temperatures of the glow plugs while applying adequate glow plug energy to facilitate engine starting and warmup based upon various sensed conditions</p> <p>Structure: Microcontroller with software control algorithms programmed to provide preglow and afterglow periods as described in Chart 1; Figure 2; Figure 11; column 11, lines 6 to 25; or column 20, lines 55 to 63 or equivalents thereof</p> <p>Pls.' Reply 12.</p>	<p>Function: Adjusting a preglow energization time and an afterglow energization time to limit excessive temperatures of the glow plugs while applying adequate glow plug energy to facilitate engine starting and warmup</p> <p>Structure: Microprocessor programmed to provide preglow and afterglow periods according to the algorithms in Chart 1 and as illustrated by the timing diagram in Fig. 2, and equivalents thereof</p> <p>Defs.' Br. 31.</p>

Claimed Function

The parties generally agree that the function of Claim 29 is “adjusting a preglow energization time and an afterglow energization time to limit excessive temperatures of the glow plugs while applying adequate glow plug energy to facilitate engine starting and warmup.” Plaintiffs seek to add language that the claimed function operates “based on various sensed conditions” because the claim language contains this limitation. Defendants, however, argue that “based on various sensed conditions” is not a necessary part of the function, and their proposed construction reads this language out of Claim 29. Defs.' Br. 32. In contrast, Plaintiffs' construction repeats this phrase as it appears on the face of Claim 29:

29. The apparatus of claim 1 wherein the programmable controller comprises means based upon various sensed conditions to adjust a preglow energization time and an afterglow energization time to limit excessive temperatures of the glow plugs while applying adequate glow plug energy to facilitate engine starting and warmup.

'258 Patent 26:11-16.

The clause “based on various sensed conditions” is incorporated into the claimed means and imports the notion that “various sensed conditions” must be present in the claimed function. See Creo Prods., Inc. v. Presstek, Inc., 305 F.3d 1337, 1344 (Fed. Cir. 2002) (“The function of a means-plus-function limitation, however, must come from the claim language itself.” (citing Micro Chem., Inc. v. Great Plains Chem. Co., 194 F.3d 1250, 1258 (Fed. Cir. 1999))). As such, the Court

adopts Plaintiffs' construction of the function of Claim 29 to be "adjusting a preglow energization time and an afterglow energization time to limit excessive temperatures of the glow plugs while applying adequate glow plug energy to facilitate engine starting and warmup based upon various sensed conditions."

Corresponding Structure

In the context of Claim 29, the parties agree that the corresponding structure is a microprocessor or microcontroller, both of which are computing elements.¹⁵ When the corresponding structure is a microcontroller or microprocessor, the structure is limited by the disclosed algorithms in the specification. Ibormeith, 732 F.3d at 1379; Typhoon Touch Techs., Inc. v. Dell, Inc., 659 F.3d 1376, 1384 (Fed. Cir. 2011). As the Federal Circuit explained:

The structure of a microprocessor programmed to carry out an algorithm is limited by the disclosed algorithm. A general purpose computer, or microprocessor, programmed to carry out an algorithm creates "a new machine, because a general purpose computer in effect becomes a special purpose computer once it is programed to perform particular functions pursuant to instructions from program software."

WMS Gaming, Inc. v. Int'l Game Tech., 184 F.3d 1339, 1348 (Fed. Cir. 1999).

An algorithm is a "sequence of computational steps to follow." Ibormeith, 732 F.3d at 1379. "The 'specification can express the algorithm in any understandable terms including as a mathematical formula, in prose, or as a flow chart, or in any other manner that provides sufficient structure.'" Function Media, LLC v. Google, Inc., 708 F.3d 1310, 1318 (Fed. Cir. 2013) (quoting Noah Sys., Inc. v. Intuit, Inc., 675 F.3d 1302, 1312 (Fed. Cir. 2012)). However, a "description of an algorithm that places no limitations on how values are calculated, combined, or weighed is insufficient to make the bounds of the claim understandable." Ibormeith, 732 F.3d at 1382. The sufficiency of a disclosed algorithm is "judged based on what a person of ordinary skill in the art would have understood [it] to disclose." Function Media, 708 F.3d at 1318 (citing Noah Sys., 675 F.3d at 1313). Both parties provided expert testimony on what disclosures in the Specification would constitute an algorithm to a person of ordinary skill in the art.

Here, the parties dispute what the disclosed algorithms in the '258 Patent are. Defendants argue that the disclosed algorithms in the '258 Patent are limited to the related disclosures in Chart 1 and Figure 2. Plaintiffs agree that Chart 1 and Figure 2 disclose algorithms, but argue that the disclosed algorithms in the Specification additionally include Figure 11, Column 11, lines 6 to 25, or Column 20, lines 55 to 63. Pls.' Reply 12. Defendants counter that Figure 11, Column 11, lines 6 to 25, and Column 20, lines 55 to 63 consist of "additional information" that "relates to other functions not claimed here." Defs.' Sur-Reply 4.

¹⁵ The parties agree that the terms "microprocessor" or "microcontroller" are synonymous and do not affect the Court's construction of the corresponding structure. Pls.' Br. 18 n.4; Defs.' Br. 33.

Chart 1 and Figure 2 are illustrative of what the parties agree constitutes an algorithm. Chart 1 is a table showing “detailed timing of glow plug operation,” in particular the preglow and afterglow energization periods based on two inputs - - temperature and voltage. The ’258 Specification explains the significance of Chart 1 and Figure 2:

For detailed timing of glow plug operation refer to chart 1 below. The meaning of the pre-glow and afterglow periods are depicted in the timing diagram of FIG. 2. The afterglow is divided into two intervals, a first interval occurs after receipt of the start signal from the start/run switch 20 and a second interval after receipt of the R-tap signal indicating the engine is running.

’258 Patent 22:52-58.

Chart 1					
Function	Temperature (degrees C.)	Voltage (Volts)	Output “ON” Time (secs)	Output “Off” Time (secs)	Total Glow
PreGlow	<=50	<=18	11.00 +/- .25	6.00 +/- .25	
PreGlow	<=50	22	7.30 +/- .25	6.00 +/- .25	
PreGlow	<=50	24	6.00 +/- .25	6.00 +/- .25	
PreGlow	<=50	28	4.50 +/- .25	6.00 +/- .25	
PreGlow	<=50	32	3.40 +/- .25	6.00 +/- .25	
PreGlow	>60	16-32	1.00 +/- .25	N.A.	
AfterGlow	<=50	18	1.0 + 0.2/-0.1	3.00 +/- .25	(See Below)
AfterGlow	<=50	22	1.0 + 0.2/-0.1	5.00 +/- .25	
AfterGlow	<=50	24	1.0 + 0.2/-0.1	6.00 +/- .25	
AfterGlow	<=50	28	1.0 + 0.2/-0.1	8.00 +/- .25	
AfterGlow	<=50	32	1.0 + 0.2/-0.1	10.0 +/- .25	
AfterGlow	>60	16-32	0	0	
AfterGlow	-40	16-32	1.0 + 0.2/-0.1	(See Above)	68 +/- 12
After R Tap	-18	16-32	1.0 + 0.2/-0.1		53 +/- 12
Signal	25	16-32	1.0 + 0.2/-0.1		32 +/- 12
	40	16-32	1.0 + 0.2/-0.1		28 +/- 12
	50	16-32	1.0 + 0.2/-0.1		25.8 +/- 12
	60	16-32	0		0

’258 Patent 23:1-23.

Figure 2 is a “timing diagram” that shows “on and off glow plug energization intervals,” i.e., the timing in which power is sent to the glow plugs, and depicts the information in Chart 1:

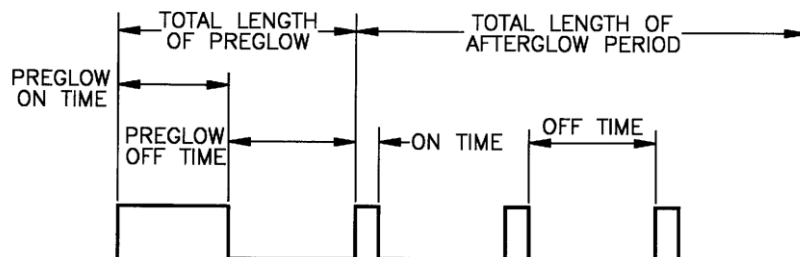


Fig.2

'258 Patent Fig. 2.

In contrast to the relationships shown in Chart 1 and Figure 2 on preglow and afterglow timing, Plaintiffs' proposed algorithm at Column 11, lines 6 to 25 is devoid of any steps or relationships between the listed variables that could affect preglow and afterglow energization periods. Lines 6 to 25 of Column 11 state:

Use of a microcontroller 150 with software control algorithms, whether fixed or interactively adapted, allows for completely independent and individualized control of switching for each glow plug or group thereof with fixed and/or varying switch control timing functions of preglow time, afterglow I and II times, afterglow cycle on times, afterglow duty cycle, afterglow cycle periods, and the like based upon: Glow plug thermal position(s) within the engine cylinder head (i.e. relative amounts of heat transfer between hot glow plugs and cooler incoming gases and to or from hot combustion gases affects glow plug heating characteristics is affected by the position of the glow plug within the cylinder head and gas flows); thermal position(s) of glow plug location in a specific engine cylinder head relative to other engine cylinders (i.e. middle engine cylinders heat up more quickly than front cylinders); and measured inputs of and/or calculated values for voltage, current, power, resistance, temperature, barometric pressure, engine age, associated cylinder compression ratio, ambient air conditions, and the like.

'258 Patent 11:6-25.

Column 11 is simply a list of input factors with no disclosure on the relationship of any of these factors to glow plug energization. Merely stating that the inputs could be "interactively adapted" fails to inform how any of these inputs relate to one another. Although the listed variables may affect temperature and voltage variables depicted in Chart 1 and Figure 2, the listed variables Plaintiffs cite in Column 11 are not themselves algorithms. The Federal Circuit has rejected the notion that a list of variables alone without a disclosed relationship could constitute a disclosed algorithm. See Iborneith, 732 F.3d at 1381 (holding that a list of identified factors related to detecting driver drowsiness in a sleep monitoring program does not amount to an algorithm when "there is no disclosure of even a single concrete relationship between the various factors that are used to compute an outcome to warn of driver drowsiness"). Although Plaintiffs note that the description in Column 11 "further informs the algorithm used to create the claimed function," a "description of an algorithm that places no limitations on how values are calculated, combined, or weighted is insufficient to make the bounds of the claim understandable." Iborneith, 732 F.3d at 1382; see Pls.' Reply 14.¹⁶

¹⁶ When asked during oral argument how the microprocessor in Claim 29 is "different from a general purpose computer if the inputs are not limited," Plaintiffs' counsel replied, "we've given you a ton of other variables in addition to [sensed temperature and battery voltage] that are also useful to provide the outputs [preglow and afterglow energization times]." Tr. 125-26. In response, the Court continued, "[y]ou see, I think part of the struggle is if you look at [column] 11,

Plaintiffs further rely on Figure 11 and Column 20, lines 55 to 63 to be disclosed algorithms for adjusting glow plug energization timing, but these portions of the Specification depict a relationship for a vehicle-start sequence. As such, Figure 11 and the cited text in Column 20 do not disclose any structure that corresponds to the claimed function - - “adjusting a preglow energization time and an afterglow energization time to limit excessive temperatures of the glow plugs while applying adequate glow plug energy to facilitate engine starting and warmup based upon various sensed conditions.” Figure 11 discloses the following graph:

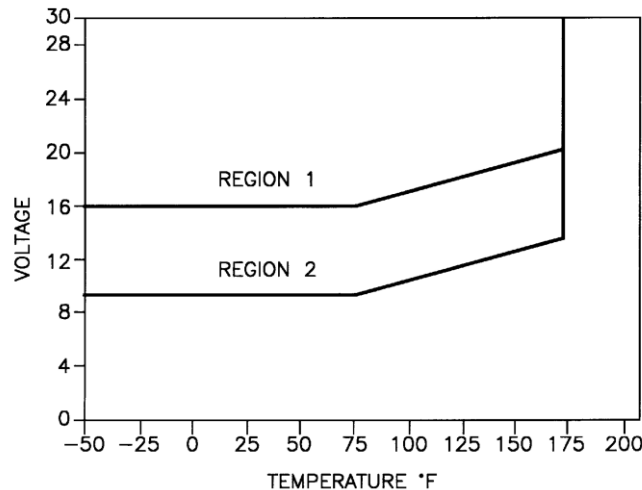
there is a litany of items, and you’re saying that all that litany taken together is an algorithm, or each individual listing is an algorithm?” Plaintiffs’ counsel responded, “[y]eah. Well, it’s any one of those, that’s exactly what I’m saying.” Id. However, Defendants replied:

So, I want to start, Your Honor’s question with respect to chart 1 and figure 2 and a general purpose computer I think was very well timed. Plaintiffs’ proposed construction essentially transforms this term, this means plus function term, into something that can merely be implemented by any general purpose computer, because as my colleague, Mr. Dunner, admitted, the disclosure that they point to in column 11 is essentially infinite in the amount of inputs that can be put into the general purpose computer, the microcontroller with software algorithm. It says “and the like.” It isn’t limited to things such as temperature and voltage, which is what chart 1 and figure 2 deal with.

* * *

If a patent owner wants to claim something but doesn’t quite know exactly what structures that they want to set forth, they might go for a broader claim and say I want the claimed means for doing one function, and here it means for adjusting preglow energization time and an after-glow energization time. But in exchange for putting in the claim functional language in an apparatus claim, which is not normally allowed, the patentee has to give up scope, and they are limited to what structures they actually disclose and then clearly link those structures to performing the claimed function.

Tr. 127, 133.

**Fig.11**

'258 Patent Fig. 11.

Column 20, lines 54 to 63 describe the chart shown in Figure 11:

FIG. 11 indicates two different operating ranges for the programmable controller of the invention. Prior to starting of the motor vehicle (during preglow), the programmable controller 150 must sense voltages and temperatures in Region 1 of the graph before the controller activates the glow plugs. Once the engine starts to crank, the drain on the battery to energize the starting motor can drop the voltage sensed by the controller. During the afterglow period, the controller must sense voltages in either Region 1 or Region 2 for the controller to continue to activate the glow plugs.

'258 Patent 20:54-63. Column 20 expressly discusses conditions that dictate when the programmable controller "activates the glow plugs," but contains no description related to the claimed function - - "adjusting a preglow energization time and an afterglow energization time to limit excessive temperatures of the glow plugs while applying adequate glow plug energy to facilitate engine starting and warmup based upon various sensed conditions." As such, Figure 11 and Column 20 do not disclose any algorithms that correspond to the claimed function.

Indeed, both parties' experts agree that the information in Columns 11 and 20, and Figure 11 do not themselves disclose algorithms, but rather are informative to understanding the algorithms disclosed in Chart 1 and Figure 2. See Alfred E. Mann Found. for Sci. Research v. Cochlear Corp., 841 F.3d 1334, 1345 (Fed. Cir. 2016) (relying on expert testimony to evaluate how a person of ordinary skill in the art would implement a disclosed algorithm based on knowledge of known laws of physics). Plaintiffs' expert testified that the information described in Column 11 "aren't algorithms per se. These are the various parts - - of data and outputs that are going into those algorithms. So this doesn't show an algorithm as it - - as you might think it would." Wilhelm Dep. 167. Defendants' expert similarly testified that Columns 11 and 20 "provide information about the structure. They don't provide you sufficient information to implement an algorithm. So they - - they provide useful information to - - to understand the

structure, but in and of themselves, the only structure that allows me to generate an algorithm would be chart 1 and figure 2.” Loud Dep. 181-82.

The Court adopts Defendants’ proposed construction of the corresponding structure. However, the Court recognizes that a person of ordinary skill in the art would consider the impact of the additional information disclosed in Column 11 on temperature and voltage as it relates to “adjusting a preglow energization time and an afterglow energization time to limit excessive temperatures of the glow plugs while applying adequate glow plug energy to facilitate engine starting and warmup based upon various sensed conditions” because such inputs like “ambient air conditions” would clearly have an impact on temperature.

Conclusion

The Court resolves construction of the disputed terms as follows:

The Court declines to construe the term “remote” as its ordinary and customary meaning indicates a distance between the power control circuitry and temperature sensor with reasonable certainty to a person of ordinary skill in the art in the context of Claim 9 of the ’870 Patent.

The Court construes the term “a voltage signals” as it appears in Claim 9 of the ’258 Patent to mean “voltage signals.”

The Court construes the term “power correction after removal or an ignition signal” in Claim 1 of the ’258 Patent to mean “power connection after removal of an ignition signal.”

The Court construes the term “until” as it appears in Claim 1 of the ’258 Patent to mean “up to the point, but not thereafter.”

The Court construes the term:

“means based on various sensed conditions to adjust to a preglow energization time and an afterglow energization time to limit excessive temperatures of the glow plugs while applying adequate glow plug energy to facilitate engine starting and warmup”

as it appears in Claim 29 of the ’258 Patent, to have a claimed function of:

“adjusting a preglow energization time and an afterglow energization time to limit excessive temperatures of the glow plugs while applying adequate glow plug energy to facilitate engine starting and warmup based upon various sensed conditions,”

and a corresponding structure to be a:

“microprocessor programmed to provide preglow and afterglow periods according to the algorithms in Chart 1 and as illustrated by the timing diagram in Fig. 2, and equivalents thereof.”

s/Mary Ellen Coster Williams
MARY ELLEN COSTER WILLIAMS
Judge